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Logging Utilization—Idaho, 1990

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Research Summary

Data collected on 20 logging operations in Idaho in 1989 provided board-foot/cubic-foot conversion factors of log scale and factors to apply to harvest volume estimates to obtain removals estimates. The components of timber products and removals, obtained by application of these factors to the 1990 Idaho timber harvest, are included. Additional findings presented in table form are the diameter distribution of trees removed from growing-stock per thousand cubic feet of products and the volume of logging residue in pieces 6 feet and longer as a proportion of product volume. Survey methods and estimates of data reliability are also presented.

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Introduction

A study to develop factors for relating Idaho's timber harvest to the standing forest inventory was conducted concurrently with the statewide forest inventory in 1989. Two other concurrent studies, timber product output (McLain and others, in preparation) and fuelwood harvest (McLain, in preparation), provided estimates of log volumes harvested and delivered to primary wood processors and to residences burning firewood. The logging utilization study, the subject of this bulletin, provides the factors to convert reported harvest volumes received by primary wood processors into cubic feet so that products using different units of measurement such as cords and board feet can be readily combined. Other factors are used to convert harvest estimates to standing inventory and thus facilitate the assessment of growth-to-cut relationships for the State. Additional factors, also to be applied to harvest volumes, provide estimates of the diameter class distribution of the harvest and the volume of residue in pieces 6 feet and longer.

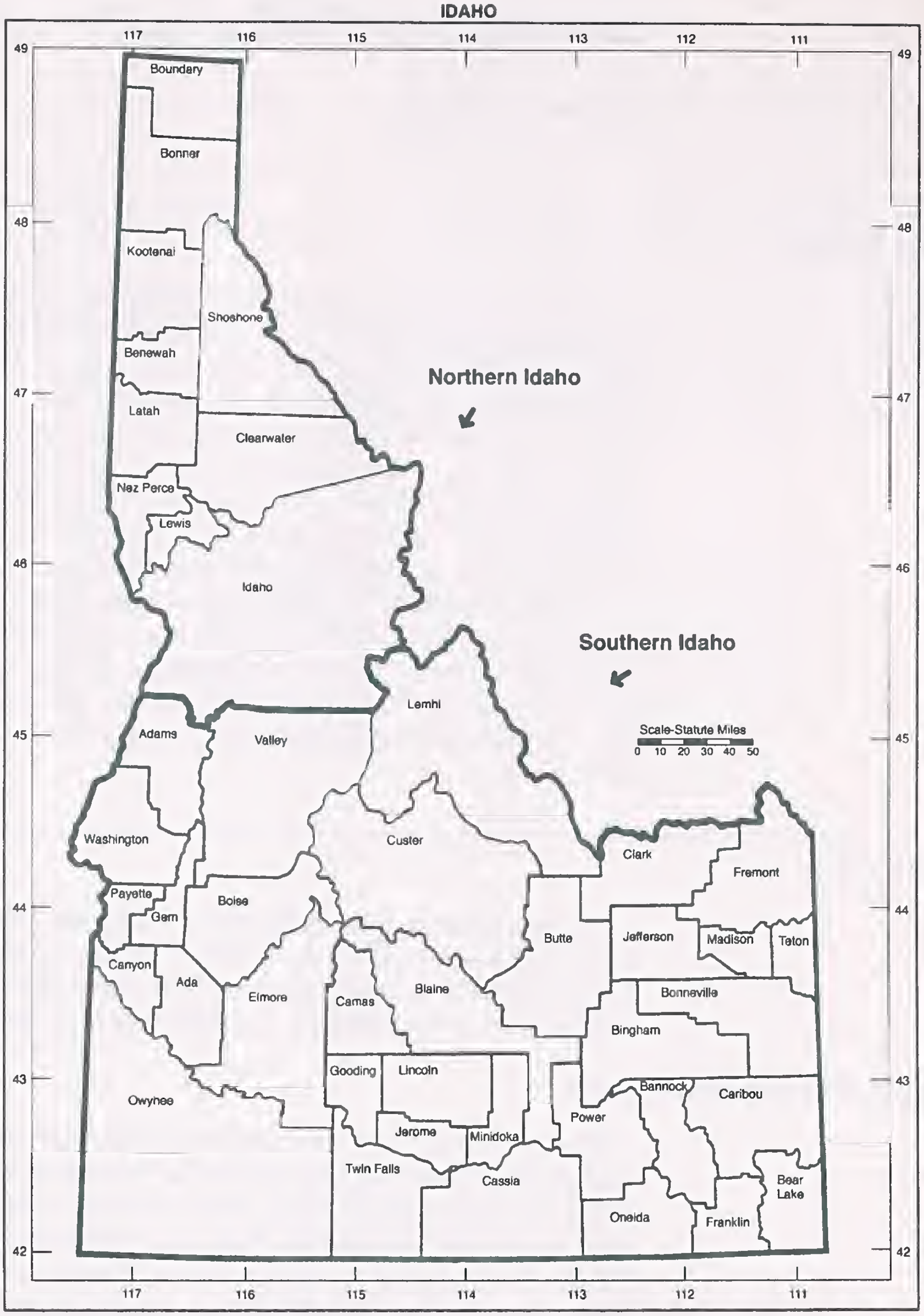
Methods

The study was conducted in Idaho using the sampling and measurement techniques designed by A. K. Wilson of the Forest Survey Project at the Intermountain Research Station from 1959 to 1960 (Wilson 1965). These techniques are described in the following two sections.

Sample Size and Distribution

Measurements were obtained in the summer of 1989 on active sawlog and multiproduct logging operations located on timberland. These operations, the basic sample units, were selected within six strata defined by land ownership and region. Four ownership classes were used: National Forest, forest industry, nonindustrial private, and State. National Forest lands were further stratified by two regions; northern Idaho and southern Idaho (fig. 1). Sample size was calculated to achieve a standard error of the logging residue/product volume ratio (total net cubic-foot volume of logging residue divided by the total net volume of timber products) of not more than plus or minus 20 percent.

The samples were distributed throughout the strata in proportion to the estimated harvest volume occurring in each stratum. Relative distribution of harvest by ownership was 45 percent from National Forests statewide, with about 75 percent of the harvest from National Forests occurring in the northern region; forest industry lands provided 25 percent; other private lands 20 percent, and State lands 10 percent. Measurements from 20 logging operations were deemed sufficient to achieve the standard error target.



In planning, 20 samples were distributed as close to these estimates as possible. In Idaho, the plan was to measure nine operations on National Forests, seven in the north and two in the south, and two operations on State lands. This distribution of operations was located and measured as planned (table 1). It was planned to measure five operations on forest industry lands and four on other private lands. However, field crews could not locate this mix of ongoing logging operations and measured, instead, five on other private lands and four on forest industry lands. After the

Table 1—Number of logging operations measured in each stratum, Idaho, 1989.

Stratum	No. of operations measured
National Forest, north	7
National Forest, south	2
State	2
Forest industry	4
Other private	5
Total	20

Table 2—The original precanvass estimate and the number of operations actually measured are provided for comparison.

		Percent of harvest	
Owner	Operations measured	Updated from mill canvass	Original estimate
National Forest (north)	7	25	35
National Forest (south)	2	17	10
Forest industry	4	21	25
Other private	5	22	20
State	2	13	10
Other owners		2	<3

mill canvass data were compiled, we estimated the actual harvest distribution in Idaho in 1990 (table 2). The distribution by ownership of operations actually measured reflected the actual distribution of the harvest closely. However, two of the operations measured on National Forests in northern Idaho should have been measured in southern Idaho, to more properly match the sample distribution to the distribution of the harvest.

Data Collection

The study design prescribed four basic measurements to be obtained from each sample unit to compute removals and logging residue factors.

On each sample unit, 8 to 21 felled and bucked product trees with an average sample unit total net volume of about 4,300 board feet (International ¼-inch rule) and a varying number of associated nonproduct trees were measured to obtain:

1. Product volume
2. Noninventory volume in products
3. Volume of logging residue from product trees
4. Volume of logging residue from nonproduct trees

All measured trees were categorized as poletimber, sawtimber, salvable dead, cull, or nontimber. Gross and net volumes in cubic feet and board feet (International ¼-inch rule and Scribner rule) were obtained by scaling. These measurements were correlated to obtain factors to apply to reported product volumes received by primary wood processors. Thus, all factors were calculated as proportions of product volume. No product volume from nontimber species was encountered on the logging operations sampled.

Study Results

The results of this study comprise cubic-foot to board-foot conversion factors, removals factors, removals volumes, logging residue volume in long pieces, and the diameter class distribution of trees harvested in 1989 on logging operations in Idaho.

Log Scale Conversions

The following product volumes resulted from scaling the logs of the 267 product trees on the 20 logging operations measured.

	Product volume	
	Gross	*Net*
Cubic	14,134	13,521
Board feet, Scribner rule	80,910	75,385
Board feet, International ¼-inch rule	91,440	86,075

The conversions appearing in table 3 were calculated using the net product volumes. These conversions are statewide averages, reflecting the average conversion for the harvest of the product mix encountered on the 20 operations measured. Caution is recommended in applying these factors to State subdivisions or to harvests of a narrow range of products of small size, such as posts or fuelwood, or to sawlogs of exceptionally large diameters.

Table 3—Net product volume conversion factors for Idaho, 1989.

1 cubic foot equals	5.5754 board feet (Scribner rule)
1 cubic foot equals	6.3660 board feet (International ¼-inch rule)
1 board foot equals (Scribner rule)	1.1418 board feet (International ¼-inch rule)

Removals Factors, Idaho 1989

The factors in table 4 are applied to reported harvest volumes to estimate growing-stock and sawtimber removals from the inventory by logging (appendix A). In this publication "removals" is limited to harvesting. The normal definition of removals includes other forms; the conversion of forest land to nonforest uses, for instance, would be considered a removal. Factors are used to estimate the amount of growing-stock or sawtimber volume in the products and the amount of logging residue associated with the product volume. Removals is the sum of these volumes (fig. 2).

The growing-stock removals factor of 1.086 means that for every 100 cubic feet of logs from live trees harvested in Idaho (table 4):

99.1 cubic feet of removals were in the logs
9.5 cubic feet of removals were residue
Total: 108.6 cubic feet were removed from the growing-stock inventory

Of the 9.5 cubic feet of removals that were residue:

8.5 cubic feet of residue came from some of the trees producing the 100 cubic feet of logs
1.0 cubic foot of residue was in trees knocked over while logging the 100 cubic feet.

And 0.9 cubic foot of the 100 cubic feet was not growing-stock removals. It came from the stumps and tops of growing-stock trees and from cull trees.

99.1 cubic feet of growing stock
0.9 cubic foot of noninventory product volume
Total: 100.0 cubic feet of product volume

For every 100 cubic feet of logs from salvable dead trees harvested in Idaho, 1.0 cubic foot of residue was produced in trees knocked over while logging the 100 cubic feet.

The sawtimber removals factor of 1.026 means that for every 100 board feet (Scribner rule) of logs from live trees harvested in Idaho:

97.3 board feet of sawtimber removals were in the logs
5.3 board feet of sawtimber removals were residue
Total: 102.6 board feet were removed from the sawtimber inventory

Of the 5.3 board feet of sawtimber removals that were residue:

5.2 board feet of residue came from some of the trees producing the 97.3 board feet of removals in the logs
0.1 board foot residue was in trees knocked over while logging the 100 board feet.

And 2.7 of the 100 board feet were not sawtimber removals; this volume came from poletimber, the tops and stumps of sawtimber, and from cull trees.

97.3 board feet of sawtimber
2.7 board feet of noninventory product volume
Total: 100.0 board feet of product volume

For every 100 board feet of logs from salvable dead trees harvested in Idaho, 0.1 board foot of residue would have been produced in trees knocked over while logging the 100 board feet.

As in the case of log scale conversions, the reader is cautioned to consider the appropriate use of these factors. For instance, harvesting operations in a stand of predominantly dead timber may produce no residue.

Table 4—Removals factors in cubic and board feet, Idaho, 1989.

Type of factor	Cubic feet	Board feet Scribner rule	Board feet International ¼-inch rule
Logging residue	0.095	0.053	0.053
Product tree residue	.085	.052	.051
Nonproduct tree residue	.010	.001	.002
Noninventory product volume	.009	.027	.028
Inventory product volume	.991	.973	.972
Growing-stock (cubic) or sawtimber (board feet) removals	1.086	1.026	1.025

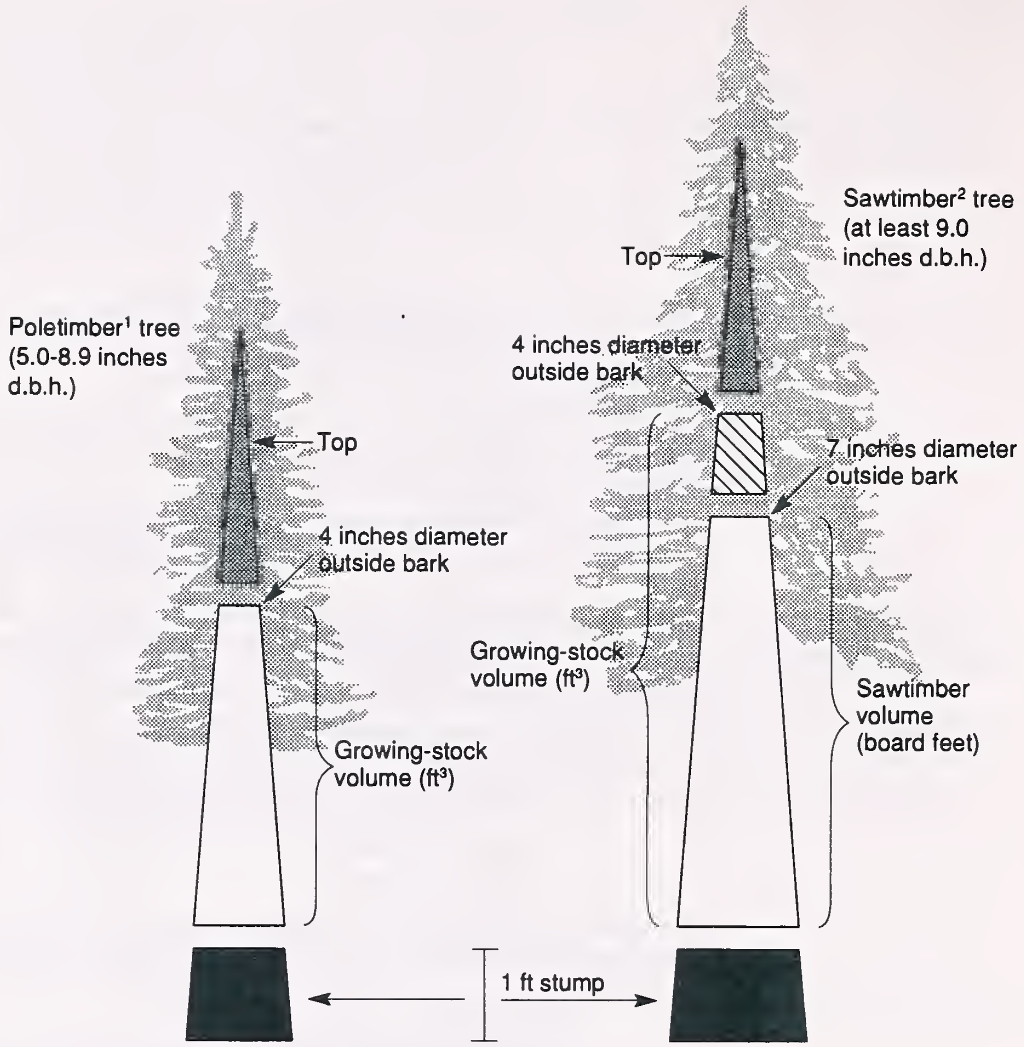

Poletimber[1] tree (5.0-8.9 inches d.b.h.)
Top
4 inches diameter outside bark
Growing-stock volume (ft³)
Sawtimber[2] tree (at least 9.0 inches d.b.h.)
Top
4 inches diameter outside bark
7 inches diameter outside bark
Growing-stock volume (ft³)
Sawtimber volume (board feet)
1 ft stump

Figure 2—Stem sections of a poletimber and a sawtimber tree. Inventory volume comprises growing-stock volume in poletimber trees and both growing-stock and sawtimber volume in sawtimber trees. Noninventory volume is shaded. Roundwood products from the noninventory portion of tree stems is noninventory product volume. Board-foot volume from poletimber trees or from sections of sawtimber trees above the 7-inch top (cross-hatched) is also noninventory product volume.

[1] Softwoods; hardwoods, 5.0-10.9 inches d.b.h.
[2] Softwoods; hardwoods, at least 11.0 inches d.b.h.

Removals and Products

Table 5 exhibits estimates of roundwood products harvested in Idaho in 1990 and the associated removals volume.

Roundwood products came from live trees (growing stock and cull), salvable dead trees, and other sources (nontimber trees and nonforest land). The product volume from live trees comprises noninventory product volume and inventory product volume (growing-stock or sawtimber volume). The growing-stock/sawtimber volume in products plus the logging residue equals the growing-stock/sawtimber removals. In table 5 industrial roundwood products are subtotaled exclusive of fuelwood to simplify comparisons and analysis.

Table 5—Timber and fuelwood production and timber removals by source of material and product, Idaho, 1990.

Products and additional removals	Product volume[1]					
	Total	From live trees	From salvable dead	Other sources[2]	Noninventory product volume	Growing-stock removals
	Thousand cubic feet					
Sawlogs[3]	251,095	232,584	18,511	—	2,093	230,491
Veneer logs[3]	30,107	24,763	5,344	—	223	24,540
Pulp and fiberwood[4]	18,185	17,125	1,060	—	154	16,971
Posts and poles[5]	4,677	3,834	843	—	34	3,800
Utility poles[6]	815	809	6	—	7	802
House logs[3]	1,676	711	965	—	6	705
Cedar products[3]	4,377	3,008	1,369	—	27	2,981
Total	310,933	282,834	28,099	—	2,544	280,290
Fuelwood[7]	22,418	1,272	19,477	1,668	11	1,261
Logging residue[8]	—	—	—	—	—	27,150
Total	333,351	284,106	47,576	1,668	2,555	308,701
						Sawtimber removals
	Thousand board feet (Scribner rule)					
Sawlogs[3]	1,399,856	1,296,657	103,199	—	35,010	1,261,647
Veneer logs[3]	167,849	138,053	29,796	—	3,727	134,326
Pulp and fiberwood[4]	81,865	77,142	4,723	—	2,083	75,059
Posts and poles[5]	—	—	—	—	—	—
Utility poles[6]	4,543	4,508	35	—	122	4,386
House logs[3]	9,346	3,965	5,381	—	107	3,858
Cedar products[3]	24,402	16,768	7,634	—	453	16,315
Total	1,687,861	1,537,093	150,768	—	41,502	1,495,591
Fuelwood[7]	115,678	7,092	108,586	—	191	6,900
Logging residue[8]	—	—	—	—	—	81,617
Total	1,803,539	1,544,185	259,354	—	41,693	1,584,108
	Thousand board feet (International ¼-inch rule)					
Sawlogs[3]	1,598,635	1,480,782	117,853	—	41,462	1,439,320
Veneer logs[3]	191,683	157,656	34,027	—	4,414	153,242
Pulp and fiberwood[4]	81,865	77,142	4,723	—	2,160	74,982
Posts and poles[5]	—	—	—	—	—	—
Utility poles[6]	5,188	5,148	40	—	144	5,004
House logs[3]	10,673	4,528	6,145	—	127	4,401
Cedar products[3]	47,016	19,149	27,867	—	536	18,613
Total	1,935,060	1,744,405	190,655	—	48,843	1,695,562
Fuelwood[7]	132,082	8,098	123,984	—	227	7,871
Logging residue[8]	—	—	—	—	—	92,797
Total	2,067,142	1,752,503	314,639	—	49,070	1,796,230

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[1] Sawlogs, veneer logs, pulp and fiberwood, post and poles, utility poles, house logs, and cedar products volumes (McLain and others, in preparation). Fuelwood volumes (McLain, in preparation).

[2] No board-foot volume in other sources.

[3] Volumes reported in thousand board feet (Scribner rule). Cubic-/board-foot conversions are from logging utilization study (table 2).

[4] Conversion factors derived from data supplied by the forest products industry to the Bureau of Business and Economics Research, University of Montana. Round pulpwood and fiberwood were reported in mixed units. These units were converted to cords. Cords were converted to thousand board feet (Scribner rule and International ¼-inch rule) using 3 cords per thousand board feet. Board feet were converted to cubic feet at the rate of 4.5 board feet per cubic foot.

[5] Posts and small poles were reported in number of pieces and their respective dimensions. The cubic volume was calculated using the dimension information, then average cubic volume per piece was calculated. Posts and small poles with small-end diameters less than 6 inches have 0 board feet.

[6] Utility poles were reported in thousand board feet (Scribner rule) and number of pieces. The conversions from thousand board feet (Scribner rule) to thousand board feet (International ¼-inch rule) and thousand cubic feet are from the logging utilization study (table 2).

[7] Fuelwood volumes were reported in cords. Cords were converted to cubic feet at the rate of 80 cubic feet/cord. Table 2 factors were used to convert cubic volume.

[8] Logging residue is associated with the harvest of industrial roundwood products. Logging residue associated with the fuelwood harvest is assumed to be zero.

The estimates of industrial roundwood products were furnished by the primary wood processors who received logs harvested in Idaho in 1990; separate estimates were provided for products from live trees and salvable dead trees. The growing-stock/sawtimber removals component of the products, the noninventory product volume component, and the logging residue volume were estimated by applying factors from table 4 to the reported harvest volumes.

The fuelwood estimates, obtained by sampling households and canvassing commercial fuelwood harvesters, were also separated into live and dead; a small volume fell into an additional category, other sources, meaning nontimber species, or timber species from nonforest land. Because the logging utilization data were not collected from fuelwood harvesting operations, some adjustments were made to estimate growing-stock/sawtimber removals associated with fuelwood. The appropriate table 4 factors were used to estimate the growing-stock/sawtimber product volume, but residue was estimated to be zero. We assumed that all growing-stock/sawtimber volume in trees cut for fuelwood and trees killed by such logging went into the product. The fuelwood product volume from growing-stock trees was very small, less than 1 percent of the growing-stock removals generated by the industrial roundwood harvest. Consequently, the propriety of applying (or not applying) factors developed from industrial roundwood operations to fuelwood harvest volumes is hardly worrisome.

Removals Factors, Then and Now

Table 6 compares the Idaho removals, logging residue, and noninventory product volume factors from data collected in 1965 (Wilson and others 1970) to those from 1989. The differences, though not statistically significant, indicate that current timber harvesting removes almost 4 percent less growing-stock volume and produces almost 3 percent less logging residue per unit of product volume than in 1965. This results from hauling more log volume to the wood processing plants relative to the growing-stock volume in the trees harvested or killed by harvesting. In other words, less wood

Table 6—Removal factors for Idaho in 1965, compared to factors computed in 1989.

Factor	1965[1]	1989	Difference
Growing-stock removals (cubic)	1.123	1.086	(–0.037)
Logging residue (cubic)	.123	.095	(–.028)
Noninventory product volume (cubic)	.000	.009	(+.009)
Sawtimber removals (board feet, International ¼-inch rule)	1.058	1.025	(–.033)
Logging residue (board feet, International ¼-inch rule)	.065	.053	(–.012)
Noninventory product volume (board feet, International ¼-inch rule)	.007	.028	(+.021)

[1] Wilson and others 1970.

is left (wasted?) in slash and stumps and more is manufactured into logs. Lower stumps were left and top logs were bucked at smaller diameters.

Current sawtimber removals per unit of product volume is about 3 percent less than in 1965. This results, partially, from increased efficiency in log manufacturing, less wood left in the slash piles and in the stump. However, part resulted from harvesting poletimber. Noninventory product volume was 2.8 percent of product volume in 1989, a 2 percent increase over 1965. One-half of this noninventory product volume was the board-foot volume in logs from poletimber. An increase in poletimber harvest as a proportion of the total harvest automatically reduces the sawtimber removals factor giving the appearance of increased log manufacturing efficiency. This might mean that up to a third of the 3 percent "gain," in board-foot log utilization was simply due to poletimber comprising a larger proportion of the 1989 harvest than the 1965 harvest. (See appendix A for factor computations.)

Logging Residue Volume in Pieces 6 Feet and Longer

Table 7 shows the factor to estimate the cubic volume of logging residue from product trees in pieces 6 feet in length and longer to a 4-inch top, the proportion of product trees producing such residue, and the volume of residue at least 6 feet long produced in Idaho in 1990. The factor, 0.066, means that residue volume in pieces 6 feet long and longer equals 6.6 percent of the product volume from live trees. In 1990, the industrial roundwood product volume from live trees (excluding fuelwood) was estimated at 282.8 million cubic feet (table 5). Applying the factor to this volume (0.066 x 282.8) results in an estimate of 18.7 million cubic feet of residue (table 7) in pieces 6 feet and longer left in the slash piles. This is comparable to the estimated 18.1 million cubic feet harvested for pulp and fiberwood (table 5). The validity of this comparison can be questioned since the desirability, given the focus on nutrient recycling, and the economic feasibility of capturing any or part of that wood volume must be considered.

The proportion of live product trees measured in the study that produced residue in pieces 6 feet and longer, 80.4 percent (table 7), gives some indication of the degree of log utilization. The lower the proportion, the higher the utilization.

Table 7—Volume, proportion of harvest volume (factor), and proportion of product trees containing logging residue to a 4-inch top in pieces 6 feet and longer, Idaho, 1990.

Residue volume in pieces 6 feet and longer (thousand cubic feet)	Factor[1] for residue volume in pieces 6 feet and longer	Proportion of product trees producing residue volume in pieces 6 feet and longer
18,667	0.066	0.804

[1] Apply to product volume, in cubic feet.

Diameter Class Distribution of Trees Harvested or Damaged

Table 8 gives information about the number of growing-stock trees and the growing-stock volume harvested or destroyed in each diameter class. Such information can be used when computing diameter class cutting rates to project residual inventory, growth, and yield. For example, in 1991, an estimated 1,407,000 growing-stock trees were in the 30-inch and larger diameter class and 51,719,000 growing-stock trees in the 12-inch diameter class on lands outside National Forests in northern Idaho (Wilson and Van Hooser 1993). We estimate that 0.89 30-inch and larger diameter class trees are removed from the inventory for every 1,000 cubic feet of product volume; for 12-inch diameter class trees, the current, 1989, factor is 2.59 (table 8). A harvest level of 158,378 M cubic feet, the estimated harvest from northern Idaho lands outside the National Forests in 1990, would reduce the growing-stock inventory of 30-inch diameter class and larger trees by 140,956 (0.89 x 158,378) or 10.02 percent (140,956 divided by 1,407,000) and the 12-inch diameter class growing-stock inventory by 410,199 trees (2.59 x 158,378) or 0.79 percent (410,199 divided by 51,719,000). The information from the 1965 utilization study is provided in table 8 and in figure 3 for comparison. It is interesting, though hardly surprising, that in 1965 there were 1.64 30-inch and larger diameter class trees removed from inventory per thousand-cubic feet of product volume, or almost twice the 1989 estimated rate, and only 1.04 12-inch diameter class trees, less than half the 1989 rate.

Table 8—Diameter at breast height (d.b.h.) class distribution of the number and volume of growing-stock trees removed from inventory through harvesting per thousand cubic feet of net product volume, Idaho, 1989—with the number of trees removed in 1965 provided for comparison. The 1965 volume by d.b.h. class is unavailable.

D.b.h. class	Number of growing-stock trees		Volume of growing-stock trees in cubic feet
	1965[1]	1989	1989
2	6.05	0.89	—
4	2.83	1.63	0.08
6	3.03	1.78	5.31
8	1.19	2.66	25.21
10	.94	3.11	54.57
12	1.04	2.59	70.65
14	1.24	2.88	109.76
16	1.24	1.92	96.80
18	1.59	2.00	135.36
20	1.09	.74	53.00
22	.69	1.11	119.20
24	.74	.52	61.67
26	.54	.30	46.21
28	.40	.37	62.22
30+	1.64	.89	246.53
All classes[2]	24.26	23.37	1,086.57

[1] Wilson and others 1970.

[2] Data may not sum to totals due to truncating or rounding.

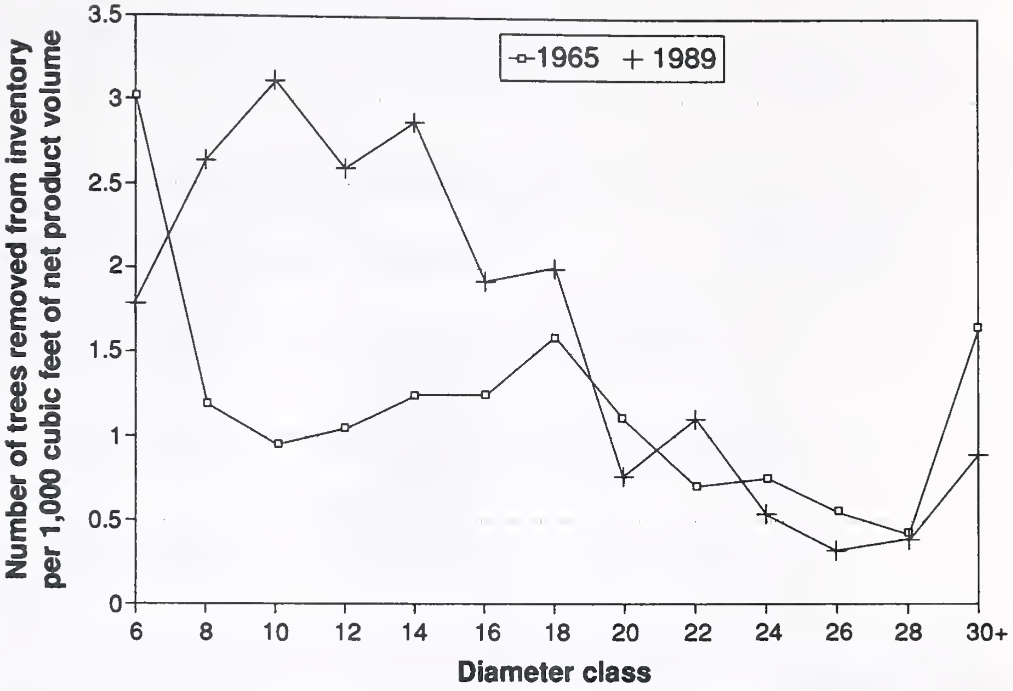

Figure 3—A comparison of the diameter class distribution of growing-stock trees removed from the inventory through harvesting per thousand cubic feet of net product volume, Idaho, 1965 and 1989.

Reliability of Estimates

The computation of the standard error of the various residue and utilization percentages employs the formula for the standard error of a ratio (Cochran 1963, p. 158), which may be stated:

$$S_R = \sqrt{\frac{\bar{R}^2}{n}\left[\frac{\sum_{i=1}^{n}(y_i-\bar{y})^2}{(n-1)\bar{y}^2} + \frac{\sum_{i=1}^{n}(x_i-\bar{x})^2}{(n-1)\bar{x}^2} - \frac{2\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{(n-1)\bar{y}\bar{x}}\right]}$$

where:

$y =$ logging residues measured on an operation (net volume)

$x =$ timber products measured on an operation (net volume)

$\bar{R} = \frac{\sum_{i=1}^{n} y_i}{\sum_{i=1}^{n} x_i} =$ logging residues ratio

$n =$ total number of operations sampled

$\bar{y} = \frac{\sum_{i=1}^{n} y_i}{n}$

$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$

$SE(\%) = \frac{S_R}{\bar{R}} \times 100 =$ standard error of the ratio as a percentage of the ratio

Table 9 gives the achieved standard errors of the logging residue volume/product volume ratios and the standard errors as percentages of the ratios.

Table 9—Achieved standard errors of the logging residue volume/product volume ratios and the standard errors as percentages of the ratios.

	Standard error of the ratio (SR)	**Standard error of the ratio as a percentage of the ratio (SE [%])**
Cubic foot	0.0147	14.07
Board foot, Scribner rule	.0167	26.21
Board foot, International ¼-inch rule	.0150	23.83

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Appendix A: Removals Factors Formulas

The factors in table 4, derived from data collected on 20 logging operations, were calculated as follows:

Growing-stock removals factor (cubic)

$$\text{Logging residue} = \text{Product tree residue factor} + \text{Nonproduct tree residue factor}$$

$$\text{Product tree residue} = \frac{\text{Product tree residue volume}}{\text{Product volume from live trees}}$$

$$\text{Nonproduct tree residue} = \frac{\text{Nonproduct tree residue volume}}{\text{Product volume from live trees and salvable dead trees}}$$

$$\text{Noninventory product volume} = \frac{\text{Noninventory product volume}}{\text{Product volume from live trees}}$$

$$\text{Inventory product volume} = \frac{\text{Inventory product volume}}{\text{Product volume from live trees}}$$

or

$$\text{Inventory product volume} = 1 - \text{Noninventory product volume factor}$$

$$\text{Growing-stock removals} = \text{Inventory product volume factor} + \text{Logging residue factor}$$

Sawtimber removals factor (board feet)

$$\text{Logging residue} = \text{Product tree residue factor} + \text{Nonproduct tree residue factor}$$

$$\text{Product tree residue} = \frac{\text{Product tree residue from sawlog sections of sawtimber trees}}{\text{Product volume from live trees}}$$

$$\text{Nonproduct-tree residue} = \frac{\text{Nonproduct-tree residue from the sawlog sections of sawtimber trees}}{\text{Product volume from live and salvable dead trees}}$$

$$\text{Noninventory product volume} = \frac{\text{Noninventory product volume from sawtimber trees} + \text{product volume from poletimber trees}}{\text{Product volume from live trees}}$$

$$\text{Inventory product volume} = \frac{\text{Sawtimber product volume}}{\text{Product volume from live trees}}$$

or

$$\text{Inventory product volume} = 1 - \text{Noninventory product volume factor}$$

$$\text{Sawtimber removals} = \text{Inventory product volume factor} + \text{Logging residue factor}$$

Appendix B: Terminology

Cubic-foot / board-foot conversions—The cubic-foot volume in product logs compared to the board-foot volume in the same logs for selected log scales.

Cull tree—A live timber species tree that is less than one-third sound.

Forest land—Land at least 10 percent stocked by forest trees of any size, including lands that formerly had such tree cover and that will be naturally or artificially regenerated. The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width at least 120 feet wide to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas are classified as forest if less than 120 feet wide.

Forest trees—Woody plants having a well-developed stem or stems, usually more than 12 feet in height at maturity, with a generally well-defined crown.

Gross product volume—The board-foot or cubic-foot volume of wood fiber in a product log(s).

Growing-stock product volume—The growing-stock volume in timber products such as sawlogs, posts, poles, pulpwood, fuelwood, and house logs.

Growing-stock removals (in this publication)—The growing-stock volume removed from inventory by harvesting. Consists of logging residue and the growing-stock volume of products.

Growing-stock trees (in this publication)—Live sawtimber trees and poletimber trees meeting specified standards of quality and vigor; excludes cull trees.

Growing-stock volume—Net cubic-foot volume in live poletimber-size and sawtimber-size growing-stock trees from a 1-foot stump to a minimum 4-inch top outside bark.

Industrial roundwood products—All timber products except fuelwood.

Inventory product volume—The growing-stock or sawtimber volume in timber products.

Logging residue—The unused growing-stock or sawtimber volume of trees cut or killed by logging and left in the woods.

Net product volume—The gross product volume less deductions for cull volume.

Noninventory product volume—The cubic volume of timber products that came from the upper stems (beyond the 4-inch top d.o.b.) or below the 1-foot high stumps of growing-stock product trees; the board-foot volume in timber products that came from poletimber trees, and from the upper stems (beyond the 7-inch or 9-inch top d.o.b.) and below the 1-foot high stump of sawtimber trees; the product volume from cull trees.

Non-national forest lands—Lands not administered by the Forest Service, U.S. Department of Agriculture.

Nonproduct tree residue—The growing-stock or sawtimber volume of nonproduct trees cut, killed, or damaged while felling or skidding product trees. This volume is left in the woods. It is a component of slash.

Nonproduct trees—Those trees cut, killed, knocked down, or destroyed due to felling and skidding the product trees.

Nontimber tree—Other than timber species.

Other sources—Product volume from nontimber species (such as juniper, and in the West, oak) and trees harvested on nonforest land (such as urban streets, orchards, and windbreaks).

Poletimber tree—A live tree of timber species, at least 5 inches diameter at breast height (d.b.h.) but smaller than sawtimber size, containing at least one 8-foot bolt, and more than one-third sound.

Primary wood processors—Mills, plants, and yards receiving logs for processing into such products as studs, boards, lumber, fiberboard, plywood, utility and building poles, house logs, excelsior, pulp and paper, pulp chips, mine timbers, railroad ties, pilings, hop stakes, grape stakes, barrel staves, siding, paneling, and shakes. Primary wood processors include sawmills, fiberboard mills, plywood plants, house log plants, post and pole yards, post and pole treating plants, excelsior manufacturing plants, and pulp and paper mills.

Product tree residue—The unused growing-stock or sawtimber volume of product trees that is left in the woods.

Product trees—Trees felled for products such as sawlogs, posts, poles, pulpwood, fuelwood, or house logs.

Product volume—The cubic-foot or board-foot volume in timber products such as sawlogs, posts, poles, pulpwood, fuelwood, and house logs. Product volume comprises volume from salvable dead trees, other sources, and the noninventory and growing-stock (or sawtimber) volume from growing-stock trees.

Removals (in this publication)—The growing-stock and sawtimber volume removed from the inventory by harvesting. Consists of logging residue and the growing-stock and sawtimber volume of products.

Residual inventory (in this publication)—The growing-stock and sawtimber volume remaining after the inventory is reduced through removals due to harvest.

Salvable dead trees—Standing or down dead trees of timber species that are merchantable by regional standards.

Salvable dead volume—The cubic volume in dead poletimber-size and sawtimber-size trees of timber species from a 1-foot stump to a minimum 4-inch top d.o.b. The board-foot volume in dead sawtimber-size trees of timber species between a 1-foot-high stump and a 7-inch d.o.b. top (softwoods) or 9-inch d.o.b. top (hardwoods).

Sawlog portion—That part of the bole of sawtimber trees between a 1-foot stump and the sawlog top.

Sawlog top—The portion on the bole of sawtimber trees above which a sawlog cannot be produced. The minimum sawlog top is 7 inches d.o.b. for softwoods and 9 inches d.o.b. for hardwoods.

Sawtimber product volume—The sawtimber volume in timber products.

Sawtimber removals (in this publication)—The sawtimber volume removed from inventory by harvesting. Consists of logging residue and the sawtimber volume of products.

Sawtimber tree—A live tree of timber species meeting regional size and defect specifications. A softwood tree must be at least 9 inches d.b.h. and a hardwood tree 11 inches d.b.h. The tree must be more than one-third sound.

Sawtimber volume—Net volume in board feet of the sawlog portion of live sawtimber trees.

Slash—The wood volume of cut or killed trees resulting from logging and left in the woods (not hauled out as timber products). Slash consists of logging residue (growing-stock and sawtimber volume) and noninventory volume (such as tree tops, limbs, cull trees, dead trees, and nontimber trees).

Timberland—Forest land where timber species make up at least 10 percent stocking.

Timber products—Roundwood products such as sawlogs, posts, poles, pulpwood, veneer logs, and house logs.

Timber removals—Same as "Removals."

Timber species—Trees traditionally used for industrial wood products. In the Rocky Mountains, these include only three hardwoods: birch, aspen, and cottonwood; and all softwood species except pinyon and juniper.

Total removals (associated with harvesting)—Comprises the growing-stock (or sawtimber) volume contained in products, the product tree logging residue, and the nonproduct tree logging residue.

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McLain, William H. 1996. Logging utilization—Idaho, 1990. Resour. Bull. INT-RB-86.
Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain
Research Station. 16 p.

Reports results of a study of timber harvesting operations in Idaho to derive factors used to estimate logging residue, growing-stock and sawtimber removals, diameter class distributions of harvests, and board-foot/cubic-foot conversions.

Keywords: timber removals, growing-stock removals, sawtimber removals, cubic-foot/board-foot conversions, logging residues

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